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Therefore,

$$\left.\begin{aligned} x_1&=3m,\\ x_2&=4m,\\ x_3&=5m,\\ x_4&=8m,\\ x_5&=10m,\end{aligned}\right|\ \text{I.}\qquad\qquad \text{Or}\qquad \left.\begin{aligned} x_1&=3m,\\ x_2&=4m,\\ x_3&=5m,\\ x_4&=\frac{15m}{2},\\ x_5&=\frac{9m}{2},\end{aligned}\right|\text{II.}$$

$$\text{Or}\qquad \left.\begin{aligned} x_1&=3m,\\ x_2&=4m,\\ x_3&=5m,\\ x_4&=\frac{18m}{5},\\ x_5&=\frac{24m}{5},\end{aligned}\right|\ \text{III.}$$

Changing II, III, to a form which shall always be integral, we have the following table of formulæ :

$$\begin{aligned} x_1&=3m,\ 6m,\ 15m.\\ x_2&=4m,\ 8m,\ 20m.\\ x_3&=5m,\ 10m,\ 25m.\\ x_4&=8m,\ 15m,\ 18m.\\ x_5&=10m,\ 9m,\ 24m.\end{aligned}$$

Where m has any integral value.

28. Proposed by DAVID EUGENE SMITH, Ph. D., Professor of Mathematics, Michigan State Normal School, Ypsilanti, Michigan.

Decompose the product 97.673.257 into the sum of two fourth powers.

I. Solution by COOPER D. SCHMITT, M. A., Professor of Mathematics, University of Tennessee, Knoxville, Tennessee.

Solution by Determinants :

$$97=\begin{vmatrix} 9 & -4\\ 4 & 9\end{vmatrix},\quad 673=\begin{vmatrix} 23 & -12\\ 12 & 23\end{vmatrix},\quad 257=\begin{vmatrix} 16 & -1\\ 1 & 16\end{vmatrix}.$$

By multiplication

$$673.97=\begin{vmatrix} 23 & -12\\ 12 & 23\end{vmatrix}\times\begin{vmatrix} 9 & -4\\ 4 & 9\end{vmatrix}=\begin{vmatrix} 255 & -16\\ 16 & 255\end{vmatrix}.$$

and

$$\begin{vmatrix} 255 & -16\\ 16 & 255\end{vmatrix}\times\begin{vmatrix} 16 & -1\\ 1 & 16\end{vmatrix}=\begin{vmatrix} 4080-16, & 255-256\\ 256-255, & 16+4080\end{vmatrix}$$

$$=\begin{vmatrix} 4096 & -1\\ 1 & 4096\end{vmatrix}=\begin{vmatrix} 64^2 & -1\\ 1 & 64^2\end{vmatrix}=64^4+1^4.$$

II. **Solution by G. B. M. ZERR, A. M., Ph. D., Professor of Mathematics and Applied Science, Texarkana College, Texarkana, Arkansas-Texas.**

$$97.673.257=(3^4+2^4)(23^2+12^2)(4^4+1^4).$$

$$(a^4+b^4)(c^4+d^4)=(a^2c^2\pm b^2d^2)^2+a^2d^2\mp b^2c^2)^2=A^2+B^2.$$

$$(a^4+b^4)(c^4+d^4)(e^2+f^2)=(A^2+B^2)(e^2+f^2)=(Ae\pm Bf)^2+(Af\mp Be)^2$$

$$=\{(a^2c^2\pm b^2d^2)e\pm(a^2d^2\mp b^2c^2)f\}^2+(a^2c^2\pm b^2d^2)f\mp(a^2d^2\mp b^2c^2)e\}^2.$$

Let $a=3$, $b=2$, $c=4$, $d=1$, $e=23$, $f=12$.

$\therefore\ 97.673.257=1^2+4096^2=3359^2+2344^2=3041^2+2744^2=1511^2+4064^2.$

Of these four sums, the first is the only one that fulfills the condition.

$\therefore\ 97.673.257=1^4+64^4$

NOTE.—*A. H. BELL*, *H. W. DRAUGHON*, *J. C. CORBIN*, and *F. P. MATZ* should have been credited with solutions of No. 22.

PROBLEMS.

40. **Proposed by F. P. MATZ, D. Sc., Ph. D., Professor of Mathematics and Astronomy in Irving College, Mechanicsburg, Pennsylvania.**

The sum of the three positive integral *cubic* roots of an equation is a square. What is the equation ?

41. **Proposed by H. C. WILKES, Skull Run, West Virginia.**

Given $\dfrac{50(a+b)}{ab}=\dfrac{81(c+d)}{cd}$......(1) ; $\dfrac{56(a+c)}{ac}=\dfrac{75(b+d)}{bd}$......(2) ; $\dfrac{65(b+c)}{bc}=\dfrac{66(a+d)}{ad}$......(3), to find the least integral values of a, b, c, d.

42. **Proposed by E. B. ESCOTT, 6123 Ellis Avenue, Chicago, Illinois.**

In a parallelogram, sides a and b, diagonals c and d, $2a^2+2b^2-c^2+d^2$. Find all the parallelograms, not rectangles, whose sides and diagonals are rational.

Examples :

a	b	c	d
4	7	9	7
16	7	21	13
8	9	13	11
8	11	17	9